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NINHYDRIN REACTION IN THE EXAMINATION OF CEREBROSPINAL FLUID*

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In 1915 Noble¹ described the ninhydrin reaction, a chemical test which he used in the examination of spinal fluids. He asserted it was of value in differentiating tuberculous meningitis from other diseases in which a clear fluid was yielded.

It is well known that in tuberculous meningitis and in poliomyelitis the cerebrospinal fluid is almost invariably clear except for a slight

TABLE 1
EXAMINATION OF 20 CASES OF TUBERCULOUS MENINGITIS; FLUIDS CLEAR

Case	Albumin	Globulin	Ninhydrin	Remarks
1	++++	++++	++++	
2	++I	++I	++	Bacilli in smear
3	++++	++++	++++	
4	++++	++++	++++	Bacilli in smear
5	++	++	+I	
6	++++	++++	++	
7	++++	++++	++++	Bacilli in smear
8	+++	+++	+++	
9	+++	+++	+++	Bacilli in smear
10	+++	+++	++	Bacilli in smear
11	++	++	++	
12	++	++	++	
13	+++	+++	++	
14	+++	+++	++	
15	++++	++++	++++	
16	+++	+++	++	
17	+++	++I	++I	
18	+++	+++	+++	
19	++++	++++	++++	
20	++++	++++	+++	

haziness as seen by transmitted light, a condition frequently found. The cytology is similar, presenting a predominance of mononuclear cells ranging from 50 to nearly 100%. The albumin and globulin content is generally higher in tuberculous meningitis and lower in poliomyelitis. Deviations are met with, and, therefore, differentiation by examination of spinal fluid is not easy. In doubtful cases, the tubercle bacilli may be demonstrated in the smear or by animal inoculation, the results of which cannot be known for 4 weeks.

* Received for publication January 18, 1917.

¹ München. med. Wehnschr., 1915, 62, pp. 975 and 1786.

The ninhydrin test is simple to perform, much easier indeed than the Noguchi-globulin test. Of a watery solution of 1% ninhydrin, 0.1 c.c. is added to 0.5 c.c. of spinal fluid in a test tube, and is then shaken and boiled for a few seconds. On cooling, a purple color turn-

TABLE 2
EXAMINATION OF 15 CASES OF MENINGISM; FLUIDS CLEAR

Case	Albumin	Globulin	Ninhydrin	Remarks
1	+	+	+	Pneumonia
2	+	+	+	Diphtheria
3	—	+	+	Pneumonia
4	+	—	+	Pneumonia
5	—	—	—	Adenitis
6	+	+	+	Peritonitis
7	+	+	+	Gastro-enteritis
8	+	+	+	Endocarditis
9	+	+	+	Pneumonia
10	+	+	+	Mastoid
11	+	+	+	Pneumonia
12	+	+	+	Pneumonia
13	+	+	+	Pneumonia
14	+	+	+	Pneumonia
15	+	+	+	Pneumonia

TABLE 3
EXAMINATION OF 35 CASES OF POLIOMYELITIS; FLUIDS CLEAR

Case	Albumin	Globulin	Ninhydrin	Remarks
1	+	+	+	
2	+I	+I	+I	
3	+I	+I	+	
4	+I	+I	+	
5	++++	++++	+++	
6	++++	++++	++	
7	+	+	+	
8	+I	+I	+	
9	+	+	+	
10	+I	+	+	
11	+I	+I	+	
12	++	++	+	
13	+	+	+	
14	++	+I	+	
15	+	++	+	
16	+	+	++	
17	+I	++	+I	
18	++++	++++	++++	
19	++	++	+	Fluid cloudy
20	+	+	+	Fluid cloudy
21	+++	+I	+	
22	++	++	++	
23	++	+I	+	
24	++	++	++	
25	+I	+I	+	
26	+I	+I	I	
27	+++	+++	++	
28	+	+	+	
29	++	++	++	
30	++	++	+	
31	+I	++	+	
32	+	+	+	
33	+	+	+	
34	+	+	+	
35	++	++	++	

ing into a deep blue appears. This indicates a positive reaction. A negative reaction gives either a straw-yellow color or no color at all. Intermediate shades of a plum color are noted, indicating a weakly positive reaction. Translated in terms of + signs, which are used in the examination of albumin and globulin, the colors of the ninhydrin reaction would correspond thus: Deep-blue = + + + +; straw-yellow or colorless = —; plum-color = + I or + +.

Tables 1-4 give the results of examinations of the spinal fluids in 20 cases of tuberculous meningitis, 15 cases of meningism, 29 cases of nontuberculous meningitis, and 35 cases of epidemic poliomyelitis.

TABLE 4
EXAMINATION OF 29 CASES OF NONTUBERCULOUS MENINGITIS; FLUIDS TURBID

Case	Albumin	Globulin	Ninhydrin	Remarks
1	++++	++++	++++	Epidemic meningitis
2	++	++I	++	Epidemic meningitis
3	++++	++++	+++	Epidemic meningitis
4	++++	++++	++	Epidemic meningitis
5	++++	++++	+++	Epidemic meningitis
6	+++	+++	++	Epidemic meningitis
7	++	++	++	Epidemic meningitis
8	++	++	++	Epidemic meningitis
9	+++	+++	+++	Epidemic meningitis
10	+++	+++	+++	Epidemic meningitis
11	+++	+++	+++	Influenzal meningitis
12	++++	++++	++++	Influenzal meningitis
13	+++	+++	+++	Staphylococcus meningitis
14	++++	++++	++++	Pneumococcus meningitis
15	++	++	++	Epidemic meningitis
16	++	++	++	Epidemic meningitis
17	++	++	++	Epidemic meningitis
18	++++	++++	++++	Pneumococcus meningitis
19	++++	++++	++++	Pneumococcus meningitis
20	++++	++++	++++	Epidemic meningitis
21	++++	++++	++++	Epidemic meningitis
22	++++	++++	++++	Epidemic meningitis
23	++	++	++	Epidemic meningitis
24	+++	+++	++++	Epidemic meningitis
25	++++	++++	++++	Epidemic meningitis
26	++++	++++	++++	Epidemic meningitis
27	++++	++++	++++	Epidemic meningitis
28	++	+++	++	Epidemic meningitis
29	++++	++++	++++	Pneumococcus meningitis

A study of the tables show that a distinct relationship exists between the albumin and globulin content and the ninhydrin reaction in any given fluid. There are 20 cases of tuberculous meningitis, in 5 of which tubercle bacilli were demonstrated in the smear. The ninhydrin reaction showed no greater intensity of color than the albumin and globulin would indicate. In the examination of the cerebrospinal fluids in 15 cases of meningism, in which there were only traces of albumin and globulin, the ninhydrin gave a corresponding faint reaction. In the 35 cases of poliomyelitis, the albumin and globulin con-

tent in the fluids ran, in general, parallel with the ninhydrin reaction. The relationship between the quantity of albumin and globulin and the intensity of the ninhydrin reaction was shown again by the results obtained in the examination of the fluids in 29 cases of meningitis. In these fluids also the globulin content ran generally parallel with the ninhydrin reaction.

CONCLUSIONS

The ninhydrin reaction in the examination of spinal fluids is of moderate differential diagnostic value.

It runs, as nearly as may be marked, parallel with the albumin and globulin content of a given fluid.

It may be used as a bedside presumptive test, but has no advantage over the albumin and globulin test, and is incomplete without the cytologic and bacteriologic examination, as it does not separate the nonpurulent pathologic fluids.